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ABSTRACT

This paper analyzes the study of the impact of recent changes in the curriculum and enrollment policies on the academic achievement of ninth graders at Hartford Public High School (HPHS), Connecticut. The most notable recent changes include establishment of the Academy for Excellence and Career Exploration for ninth graders and the School-to-Career program. Enrollment in the Academy for Excellence and Career Exploration is required of all ninth graders, who are then grouped into three "houses" to provide ongoing student support. The Academy provides students with individualized attention to support academic achievement and monitor behavior. The School-to-Career program in which students at all grades participate focuses on the promotion of students' career interests, collaborative learning, and technology-based education. The analysis of ninth-grade student records at HPHS for the first reporting period of 1998 and 1999 shows significant differences in favor of the 1999 cohort, with higher mean achievement scores in English, mathematics, and science. Mean scores of ninth graders in 1998 were in the failure range, but those for 1999 ninth graders were in the "average" to "below average" range. It is too early to attribute these improvements to the Academy and School-to-Career programs but it is plausible to assume that this new approach may be an important contributing factor. An appendix contains an analysis of academic achievement data. (SLD)

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ED 438 330

Hartford Public High School

ANALYSIS OF 1998 & 1999 FIRST QUARTER 9TH GRADE STUDENT RECORDS

January 2000

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Hartford Public High School

Analysis of 1998 & 1999 First Quarter 9th Grade Student Records

EXECUTIVE SUMMARY

A long-term partnership between Hartford Public High School (HPHS), Hartford Public Schools, Connecticut State Department of Education (CSDE), Connecticut Business and Industry Association (CBIA), and business and industry located in the greater Hartford area has supported development of an Academy For Excellence and Career Exploration and a School-to-Career curriculum for 9th graders at HPHS. In December 1999, CBIA retained Curriculum Research and Evaluation (CRE) to conduct a study comparing 1998 and 1999 first quarter records for 9th grade students enrolled at HPHS.

The main question for this study is: *What has been the impact on 9th grade student academic achievement from recent changes in the HPHS curriculum and enrollment policies?* The most notable recent changes include the "9th Grade Academy for Excellence and Career Exploration," which was developed by the Principal and his staff in association with external resources, and the School-to-Career program, which is supported by a CBIA partnership with The Hartford Group, United Technologies Corporation, CSDE, HPHS, and Hartford Public Schools.

Analysis of data indicates that a significant and relevant new instructional program—the Academy for Excellence and Career Exploration—has been implemented at HPHS, especially for entering 9th graders. This new program involved sustained work during the past five years in the following areas: program design, curriculum development, professional development, enrollment policy, and the School-to-Career initiative. Key participants were Joseph Wall, Principal; Jose Colon, Assistant Principal; Ronnie Skerker, CSDE representative; and Dayl Walker, CBIA representative.

Enrollment in the Academy for Excellence and Career Exploration is required for all entering 9th graders. Three "houses" in the Academy for Excellence ensure the greatest opportunity for individual students to realize success with the 9th grade curriculum and support their completion of high school graduation requirements. The principal and staff established measurable goals for the main components of the Academy for Excellence.

Analysis of dropout data from HPHS reveals that the 9th grade has the highest record of dropout and, thus, should be targeted for intervention.

The Academy for Excellence is a direct response to citizen and committee recommendations for lowering the dropout rate. It provides students with individualized attention to support their academic achievement and to monitor their behavior—namely, the incidence of attendance and Major Disciplinary Occurrences. Also, professional development opportunities for teachers and staff are keyed directly to the program and to students' learning needs, their emotional needs, and their social-psychological needs.

Additionally, the opportunities available to students in their 10th, 11th, and 12th grades are consistent with the Academy for Excellence and are highly supportive of the School-to-Career program that CBIA and its partners have promoted, since 1994. The main elements of this School-to-Career program are hands-on learning, student-centered and student-directed activities, collaborative learning, technology-based education, and promotion of students' career interests through mentors, job shadowing, company site visits, and internships. During the developmental and implementation stages, the administration and teaching staff at HPHS have cooperated fully with representatives from CSDE and CBIA and with other external resources.

An important new development at HPHS is the Pitsco science laboratories where 9th grade students work individually and in small groups with guidance from their teachers to master the science curriculum. Pitsco provides an integrated approach to science education that incorporates the latest technology, includes objective-based assessment devices, and provides students with opportunities for self-directed learning as well as collaborative activities.

Teachers, administrators, and other observers report that students are highly motivated by the Pitsco labs. Average Daily Attendance seems to be improving as a result of implementing this innovative science curriculum. *CRE's preliminary analysis of student performance data suggests that the students not only like the new science labs, but also that they are learning English, mathematics, and science.*

This analysis of 9th grade student records at HPHS for the first reporting period of 1998 and 1999 reveals significant differences in favor of the 1999 cohort of students. The mean scores of the 1999 9th graders for English, math, and science were higher than the mean scores for the 1998 9th graders in these same subjects. Also, the mean scores for the 1998 9th graders were in the failure range, whereas the mean scores for the 1999 9th graders were in the "Average" to "Below Average" range (59% is failure at HPHS).

Although it is too early in the study to attribute observed differences in students' achievement to the new 9th grade Academy for Excellence and

Career Exploration and the School-to-Career program, it is nonetheless reasonable to report that the analysis of data shows positive achievement results among 9th graders at HPHS. A more thorough research design and a longitudinal study are required to clarify the sources of main effects in the data. It is at least plausible that this new approach to 9th grade education at HPHS may be a major contributing factor influencing students' higher achievement, lower absenteeism, and lower Major Disciplinary Occurrences. That is very good news for Hartford Public High School, for the Hartford Public Schools, for the Connecticut State Department of Education, and for the Connecticut Business and Industry Association.

On the basis of this preliminary study, CRE strongly encourages all interested parties to continue their support of the Academy for Excellence and Career Exploration and the School-to-Career programs. Additionally, this public and private sector partnership should insist on systematic analysis of program and student performance data, so that long-term positive results are assured—especially for Hartford's youth and their careers.

This report includes specific recommendations for continued development.

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Hartford Public High School

Analysis of 1998 & 1999 First Quarter 9th Grade Student Records

INTRODUCTION

In December 1999, Connecticut Business and Industry Association (CBIA) retained Curriculum Research and Evaluation (CRE) to conduct a study comparing 1998 and 1999 first quarter records for 9th grade students enrolled at Hartford Public High School (HPHS) in Hartford, CT. This study received full cooperation from Joseph Wall, Principal of HPHS, who was assisted by Jose Colon, Vice Principal at HPHS and Ronnie Skerker of the Connecticut State Department of Education (CSDE). Dayl Walker, School-to-Career Program Manager at Connecticut Business and Industry Association (CBIA), managed this research initiative.

The main question for this study is: *What has been the impact on 9th grade student performance from recent changes in the HPHS curriculum and enrollment policies?* The most notable recent changes include the "9th Grade Academy for Excellence and Career Exploration," which was developed by the Principal and his staff in association with external resources, and the School-to-Career program, which is supported by a CBIA partnership with The Hartford Group, United Technologies Corporation, CSDE, HPHS, and Hartford Public Schools.

The main purpose of this study is to reveal whether and how the school-to-career program at HPHS enables students to perform at higher levels in academic subjects than in traditional programs and lowers incidence of tardy, absence, and Major Disciplinary Occurrences (MDO). Over time, baseline data from this study will show that—due to the school-to-career program:

- students' grades at HPHS are higher
- students understand better the relationship between the world of work and school, and
- students continue schooling until graduation.

CRE's main responsibility was to collect, to analyze, and to report relevant and significant findings in this comparison study of existing demographic and performance data from 9th grade students enrolled during the first quarter reporting period at HPHS during 1998 and 1999.

Preliminary analysis of data indicates that the program is accomplishing its objectives in the areas of academic achievement and school-appropriate behavior. (See Appendix for Analysis of Student Academic Achievement Data.)

DESCRIPTION OF SCHOOL AND PROGRAMS

Hartford Public High School, located in Hartford, CT, is a racially, ethnically, and economically diverse comprehensive high school. It serves students in grades 9 through 12. Additionally, HPHS has the distinction of being the oldest public high school in the city. The total high school population for Hartford is approximately 4,500. Annually, HPHS serves approximately 1,500 students (or 33% of the total student population). The remaining students attend one of the other two high schools in the city—Bulkeley High School or Weaver High School.

The HPHS program is organized in the following manner.

- 9th Grade Academy for Excellence and Career Exploration with three main houses (Mark Twain House, Harriet Beecher Stowe House, and Day House)
- 9th Grade Classical Academy
- 9th Grade Bilingual Program
- Technologies Academy
- Humanities and Fine Arts Academy
- Classical Magnet Academy

As of August 1999, attendance in the Academy for Excellence is required for all newly enrolled 9th grade students—except students enrolled in the Classical Academy and the Bilingual Program. Students who successfully complete the Academy for Excellence may enter one of the other academies for completion of high school graduation requirements. Development and implementation of the Academy for Excellence is a direct response to recommendations received from parents and HPHS staff subsequent to the recently initiated accreditation process and accreditation reports.

History of Technologies Academy

The 9th grade Academy for Excellence and Career Exploration is a further development and refinement of the school-to-career program that began in 1994 and eventually was called the HPHS Technologies Academy. The Technologies Academy stemmed from a partnership between HPHS, CBIA, CSDE, The Hartford Group, and United Technologies Corporation (UTC)[1]. These key players had a common interest in significantly improving students' chances of success in school and careers. In 1998, UTC retained CRE for the purpose of evaluating the progress and effects of the HPHS Technologies Academy. Many of the recommendations that CRE presented to the partnership as a result of the evaluation have been incorporated in the 9th grade Academy for Excellence.

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[1]For a more thorough discussion of the origins of the HPHS school-to-career program, the reader should consult "Hartford Education Initiative: 1998 Evaluation Study," which CRE completed for UTC and the CBIA partnership. Additionally, a list of 25 recommendations for improving the HPHS Technologies Academy was submitted by CRE to UTC in a three-page letter dated March 17, 1999.

All of the key themes of the original plan for the Technologies Academy have been continued in the 9th Grade Academy for Excellence and Career Exploration, namely standards-based education, technology-rich instruction and learning, collaborative and cooperative tasks, and hands-on learning.

One of the most important new features of the HPHS 9th grade program is principal's development and implementation of objective and measurable goals that are specific to each of the different houses in the 9th Grade Academy for Excellence. Students who successfully complete all course requirements for the particular Academy automatically proceed to the 10th grade. Students who do not meet the standards will not leave the Academy until assessment indicates they are capable of successfully completing 10th grade courses. Thus, every student, regardless of the Academy in which he or she is enrolled, receives full credit for successfully mastering 9th grade standards.

A second significant element of the HPHS 9th grade Academy for Excellence is the Pitsco Synergistic Systems for teaching science. HPHS implemented Pitsco in fall 1999 as a key component for school-to-career education. Pitsco, Inc., with headquarters in Pittsburg, Kansas, developed this self-contained, fully integrated and technology-rich approach to math, science, and technology education. Its state-of-the-art learning environment provides standards-based curriculum framework and materials, instructional technology, assessment instruments, and furniture for hands-on, discovery-oriented learning.

Indeed, the Pitsco Synergistic Systems came on the market at the most favorable time to provide HPHS teachers and administrators with a fully developed and integrated science curriculum that includes two levels—one for middle school and one for high school—both of which are instrumental for the HPHS 9th grade program. At present HPHS has the middle school program operational, which is exactly what HPHS 9th graders need, since they are making the transition from middle school to high school and since a significant majority of these students have below average achievement in basic skills. Additionally, the science grades that HPHS students receive are based upon students' completion of Pitsco assessment systems, not from teacher-made tests.

Two classrooms at HPHS have been converted to the Pitsco program and are reserved for the 9th grade Academy for Excellence program. Included in these rooms are several fully equipped multi-booth modules or workstations where individual students or small groups of students engage in science lessons under the direction of their teachers. Prior to the start of the 1999-2000 school year, teachers and administrators participated in an on-site training program at Pitsco's headquarters. This program—including the equipment and professional development—cost $250,000 and was paid for

through a collaborative partnership which included HPHS, HPS, UTC, CBIA, and other area businesses and industries.

A third outstanding feature of this new program for 9th graders at HPHS is a "Letter of Intent" that each teacher and staff member signs prior to being assigned to this duty. The Letter of Intent specifies the main goals of the Academy for Excellence and Career Exploration, the expectations of students and staff, and the professional outlook appropriate for this assignment (namely, that every student can succeed when given help).

The following sections present the goals, selection criteria, special features, and exit standards for the various houses in the Academy for Excellence.

Mark Twain House

Goals: All students will increase their reading, writing, and computing skills and will enter the sophomore year prepared to take courses on the academic and honors level. Additionally, 75% of all students will meet state goal on the CAPT and at least 90% of the standards by June 2000.

Selection Criteria: All incoming 9th grade students who have met the 8th grade Connecticut Mastery Test (CMT) goals for reading, writing, and mathematics.

Special Features: Students will be involved in an accelerated program that emphasizes development of reading, writing, listening, and computing skills. Additionally, students will be linked to the Mark Twain House Writing Program. Also, CAPT and SAT training programs will be available during classroom hours, after school, and summer school.

Exit Standards: Students will exit Mark Twain House after one year of successful completion of established competencies and enter the Academy of their choice.

Harriet Beecher Stowe House

Goals: All students will be reading, writing, and computing on grade level at the end of one or two years enrollment in Stowe House. Additionally, at least 60% of these students will meet state goals on the CAPT and all students will successfully complete at least 90% of the standards by June 2000. Also, 90% of the students will not exceed 15 absences.

Selection Criteria: All students will have scored between 50 and 62 in reading and between 100 and 130 in math on the CMT.

Special Features: Students will be involved in an intensive interdisciplinary program with an emphasis on literacy, a Personalized Learning Plan, and assigned regularly to groups for cooperative and collaborative work. Class

instruction will not be restricted to the 45 minute period, but instead teachers will design the instructional program in order to accomplish teaching and learning objectives. Every student will have a teacher advocate who will contact families on a bimonthly basis and will develop strategies to ensure the student's success with the expected low absenteeism rate. Bilingual and special education students will be placed in this House based on their Individual Education Plan (IEP).

Exit Standards: Students will exit Stowe House with competencies in reading, writing, listening, and computing that are at or near grade level and a career focus that will allow them to succeed in the Arts and Humanities Academy or the Technologies Academy. Students who are not able to meet the stated standards will be placed in an alternative setting.

Day House

Goals: All students will be reading, writing, and computing on or near grade level at the time they receive their high school diploma. Additionally, 90% of all students will successfully complete the stated standards within a two year period of time.

Selection Criteria: All incoming 9th grade students who have scored below 50 in reading and below 100 in math as measured by the CMT.

Special Features: Students will be involved in a rigorous program to address individual learning needs in reading, writing, listening, and computing as well as programs that address social skills and emotional development. Interdisciplinary units will incorporate age appropriate materials and a Personal Learning Plan will be developed and monitored for each student. Class instruction will not be restricted to the 45 minute period, but instead teachers will design the instructional program in order to accomplish teaching and learning objectives. Every student will have a teacher advocate who will contact families on a bimonthly basis. Bilingual and special education students will be placed in this House based on their Individual Education Plan (IEP).

Exit Standards: Students will exit Day House with reading, writing, and computing skills on or near grade level; with social skills training; and with a career focus by the time they receive their high school diploma. Students who are not able to meet the stated standards will be placed in an alternative setting.

This report does not focus on the other 9th grade options, namely the Classical Academy and the Bilingual Program. Nor does this report go into depth with the programs that have been established for 10th, 11th, and 12th grades, namely the Technologies Academy, Humanities and Fine Arts Academy, and the Classical Magnet Academy. Nevertheless, the following information is provided as a brief overview of these programs.

Classical Academy
An honors program through which all students must meet the same exit standards for matriculation to 10th grade.

Bilingual Program
A program designed for non-English speaking students who must meet the same exit standards for matriculation to 10th grade. Provision has been made for bilingual and special education students to enroll in the Stowe and Day houses.

Technologies Academy
A program to provide an exemplary school-to-career high school education to geared to the interests and abilities of each individual student. Entrance into the Technologies Academy begins in the 10th grade with successful completion of 9th grade requirements. Successful completion of the Academy for Excellence and Career Exploration is a prerequisite and provides all students with a curriculum that supports transition to the Technologies Academy.

Humanities and Fine Arts Academy
Provides an instructional program where students achieve high academic standards through critical thinking, problem solving, and experiential learning—where the arts are integrated in a fundamental way to all areas of the curriculum. Students are encouraged to pursue higher education and to develop a commitment to lifelong learning. Successful completion of the Academy for Excellence and Career Exploration is a prerequisite and provides all students with a curriculum that supports transition to the Humanities and Fine Arts Academy.

Classical Magnet Academy
A college preparatory program where the curriculum emphasizes studies of classical literature and languages, structured academic courses, and interdisciplinary study, including the Trinity College Lecture Series and the St. John's College Seminars. Successful completion of the 9th grade Classical Academy is a prerequisite and provides all students with a curriculum that supports transition to the Classical Magnet Academy.

SUMMARY OF PROGRAM DEVELOPMENT 1998-1999

The following chart provides a listing of the major differences and changes in programs for the 9th grade at HPHS from 1998 to 1999.

1998	1999
PROGRAM • Regular 9th grade program • Smaller number of students held back at middle school	**PROGRAM** • Freshman Academy concept & design written • Percent of students held back at middle school slightly higher • Implemented the Pitsco Labs for student-centered laboratory science ▸ Science content is similar to 1998 ▸ Science content is more sophisticated ▸ Science content has more mathematics ▸ Student-centered approach ▸ Student-driven approach ▸ Computer-based educational program ▸ Varied activities to engage students (including interactive, project-based programs and self-selected activities) ▸ Career exploration specific to each module explored by students ▸ Students work in teams ▸ Students work with different partners on a rotating basis ▸ Students engage regularly in highly motivating activities.
• 9th graders are part of entire high school population	• 9th graders are semi-segregated from other high school students
STAFF DEVELOPMENT • Limited resources to bring in staff development program • No overall plan for staff development • No unified effort for staff development	**STAFF DEVELOPMENT** • Infusion of $250,000 for curriculum and staff development • Science Area – All science teachers and several support staff members receive four days of Pitsco training on sight. • Landmark College provides three day training for all science and social studies teachers on literacy and use of master notebook • Math teachers trained on new integrated math series for improvement of students' numeracy • Established a clear plan for staff development • HPHS staff development plan is supported through HPS Central Office
ASSESSMENT • Science assessment – teacher developed • Literacy assessment – teacher developed	**ASSESSMENT** • Science assessment – embedded assessment is part of the Pitsco program, including a variety of assessment tools • Literacy assessment – embedded assessment is part of the Pitsco program, including a variety of assessment tools and testing to mastery level
STAFF • Teachers planned classes individually and dealt with students individually • administrators and guidance counselors' work done alphabetically	**STAFF** • Common planning time during which teachers focus on students' needs, parent conferences, and cluster meetings for teachers to work together on students needs • One administrator and two guidance counselors for entire Academy

STUDENTS	**STUDENTS** • Clusters of students organized based on CMT scores • Repeating 9th graders are kept together as a group • Inclusion of special education students (total 16) 15 of which are succeeding in mainstream courses with no modification of their program • Special education students are exposed to employability skills with other students
SUPPORT SERVICES	**SUPPORT SERVICES** • Implemented an integrated guidance service

Analysis of the documentation included in the above chart indicates that HPHS implemented substantial changes in the 9th grade curriculum, professional development, assessment, and other key areas for the 1999-2000 academic year. A major factor that provided overall support and an organizational structure for these changes was implementation of the Pitsco Laboratories for Science. As indicated previously, funding for Pitsco was made possible by the school system and a CBIA partnership of local business and industry.

Additionally, CRE examined records of team meetings that were convened by the three houses during the 1999 fall reporting period. These documents indicate that teachers, counselors, and administrators responded quickly and effectively to inappropriate behavior of students. They made special efforts to contact parents or guardians to inform them of their child's behavior, collaboratively developed plans to address needs of individual students as well as groups, and monitored and documented students' absenteeism, tardiness, and suspension.

Also, on the basis of her examination of program offerings in the Pitsco laboratories and preliminary effects, the teacher in charge of the Bilingual Academy has made plans for her students to use these modules for their science curriculum.

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STUDENT DEMOGRAPHICS AT HPHS

According to the scheduling department at HPHS, the total enrollment at HPHS during January 2000 was 1,549 students. Figure 1 presents the analysis of current student enrollment data by class division with categories for female, male, and total enrollment.

Figure 1: Student Enrollment January 2000

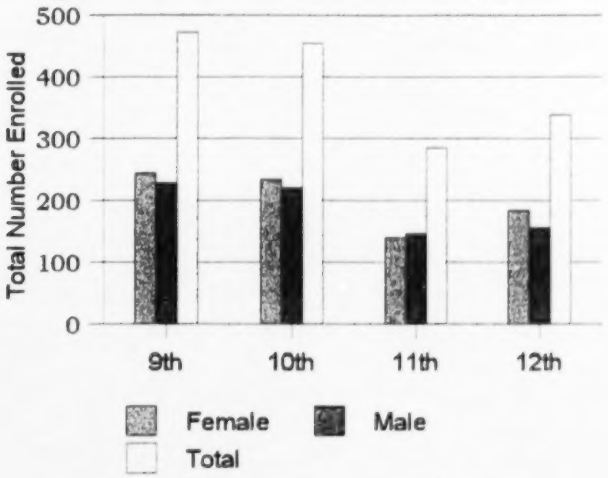

Figure 1 suggests that the greatest difference in class enrollment (37%) lies between the 10th and 11th grades. However, Figure 1 also indicates that the difference in enrollment between 9th and 10th grades is very small—4%. Additionally, enrollment records across 11th and 12th grades shows a higher number of enrolled 12th graders (19%)for this particular report.

Documentation that CRE obtained from the most recent Strategic School Profiles compiled by CSDE (1998-99) indicates that the student population at HPHS also has the following characteristics.

Current and Past School Need	HPHS	ERG[2] High Schools	State High Schools
% Students Eligible for Free/Reduced-Priced Meals	87.4	59.3	17.8
% K-12 Students with Non-English Home Language	60.9	37.1	11.6

[2]To assist in reporting and analyzing school district data, the State Department of Education developed Educational Reference Groups (ERGs), which are designed to compare groups of districts that have similar characteristics. The state's 166 school districts and three academies have been divided into nine groups. Each group is based on socioeconomic status, indicators of need, and enrollment.

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Thus, data from CSDE regarding eligibility for free/reduced-priced meals and incidence of non-English home language shows that a significant majority of students who attend HPHS are disadvantaged in comparison to their peers who live in other areas of the state and who attend public high schools classified in other ERGs.

Analysis of data from HPHS pertaining to students' race/ethnicity reveals the following results.

Race/Ethnicity	Percent
American Indian	.1
Asian American	2.7
Black	34.3
Hispanic	58.8
White	4.1

As the above table demonstrates, a significant majority (95.5%) of students who attend HPHS are classified as minority. A great majority (93.1%) of these students are either Black or Hispanic, with the greater percentage being Hispanic. Documentation from the school and from CSDE indicates that HPHS engages its students regularly in a variety of activities to provide for interaction with students and teachers from diverse racial, ethnic, and economic backgrounds.

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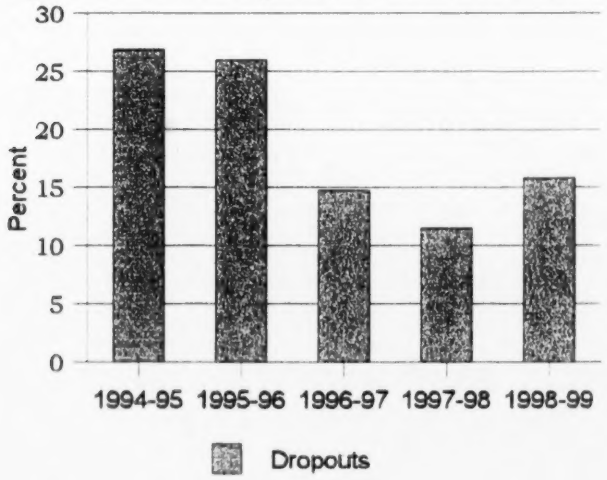
PRELIMINARY RESULTS

Figure 2 presents a dropout summary report. Data for this chart was obtained from the scheduling office at HPHS to reveal the total population of students (i.e., 9th, 10th, 11th, and 12th grade students) who dropped out of school at HPHS during the period 1994-95 through 1998-99.

Figure 2: Percent Dropouts 1994-95 to 1998-99



Clearly, Figure 2 shows that the trend toward an overall *lower* dropout rate at HPHS began in the 1996-97 school year—which is good news.

Figure 3 presents the report of dropouts for school year 1998-99 for 9th, 10th, 11th, 12th graders, and the total HPHS student population. Once again, data for this chart came from the scheduling department at HPHS.

Figure 3: Dropouts 1998-99

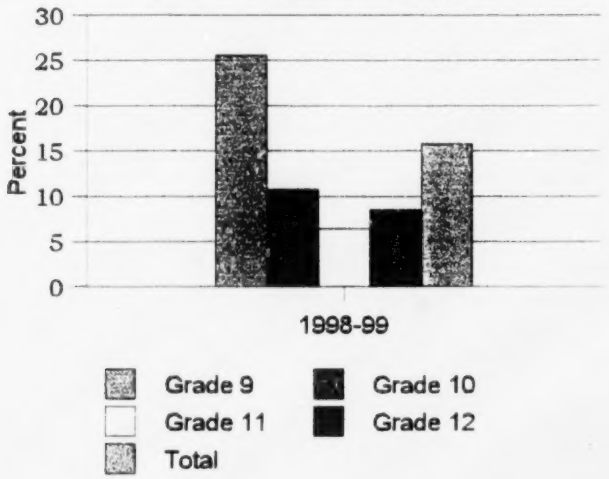


Figure 3 reveals that the greatest incidence of dropout (recorded here as a percentage of the fall 1998 class enrollment for 9th, 10th, 11th, 12th grades, and total population) during the 1998-99 school year occurred among 9th graders. More specifically, data from HPHS indicates that 669 students enrolled in the 9th grade during fall 1998. However, by the end of the 1998-99 school year, 171 (i.e., 25.6%) of these students had dropped out of HPHS.

Figure 3 also indicates that after the 9th grade there is a sharp decrease in the incidence of dropout among 10th, 11th, and 12th graders. Indeed, since the dropout rate for the 1998-99 school year for the total population was 249 (i.e.,15.8% of the total student population—1,579 students), the incidence of dropout among 9th graders at HPHS constitutes nearly one half of all dropouts.

Documentation from HPHS shows that the fall 9th grade enrollment figures for HPHS have varied over the years, but the tendency since 1995-96 has been toward lower numbers (i.e., 1995-96: 875; 1996-97: 934; 1997-98: 737; 1998-99: 669; 1999-00: 472 students).

The basic message of Figure 3 is that a large number of 9th graders do not return to HPHS for the 10th grade. Some of these students may attend other high schools in the city, other high schools in CT or other states, and some may never graduate from high school. Also, some of these students who drop out of the 9th grade at HPHS actually may return to HPHS after a brief stint in another high school—particularly if they learn about a high school program that is a better match for their personal interests and learning needs. However, a more thorough collection and analysis of data over time is required to understand the dropout phenomenon at HPHS, specifically, and the complex of dropouts and re-enrollment at Hartford Public Schools, in general. The subsequent analysis of dropout data could provide valuable information to HPHS and to CSDE for planning and decision-making.

Figure 3 also shows that there is likely to be an increase in the incidence of dropout for the 12th grade cohort at HPHS.

Unfortunately, at this time it is not possible to report on the incidence of dropout among students enrolled in any of the classes at HPHS for the 1999-2000 school year. That data will not be available until summer 2000.

Nevertheless, educators, policy makers, and school/business partners in CT must ask themselves what can be done to attract and to hold these youngsters in school so that they successfully complete the requirements for high school graduation.

One answer that has considerable potential and that was implemented recently at HPHS is the 9th grade Academy for Excellence and Career Exploration. In essence, offering this new program entailed restructuring the academic curriculum, changing the instructional program to include hands-on activities and student-directed learning, and developing new enrollment policies. The main purpose was to demonstrate immediately to the 9th graders the value that a high school education has for developing their workplace skills and attitudes.

When school reflects the real world in which students live and, especially, when it provides opportunities for youth to explore career choices through hands-on classes and apprenticeships in technology-based industries, they respond by staying in school until graduation. Students express genuine satisfaction with learning basic skills and workplace skills when they know the classroom meets their needs, talents, and interests. Then, with the high school diploma in hand four years later, students will have at least the basic qualifications to enter the world of work, pursue various employment opportunities and, benefit from lifelong learning.

CBIA's partnership for the School-to-Work[3] program supports this approach. Indeed, anecdotal data from students, teachers, administrators, and representatives from area business and industry strongly suggest that the Academy for Excellence is already accomplishing one of its main purposes: to motivate students to stay in school.[4]

Also, CRE's preliminary analysis of 9th grade student performance data shows that, in fall 1999, 9th grade students on average realized higher grades in English, math, and science—with substantially higher grades in science. On the basis of these results, it is plausible to conclude that the increase in grades is due at least in part to the newly implemented curriculum—especially the science curriculum.

However, CRE considers this analysis of data to be tentative, because consistent and more systematic collection of data over time is required.

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[3]School-to-Work is supported by the National Conference of State Legislators through its Education, Labor, and Job Training Committee and funding from the School-to-Work Opportunities Act of 1994.

[4]Included in the collection of documents CRE obtained from HPHS are letters from students expressing their appreciation to Mr. Wall, the Principal, for his steadfast support of the Academy for Excellence. These records of positive sentiment are reinforced by highly positive comments that CRE received from teachers, assistant principals, and the representatives from CSDE and CBIA.

CONCLUSIONS

Analysis of documents and interview data that CRE obtained from HPHS staff and from various external partners indicates that a significant and relevant new instructional program—the Academy for Excellence and Career Exploration—has been implemented at HPHS, especially for entering 9th graders. This new program is a result of sustained work during the past five years in the following areas: program design, curriculum development, professional development, enrollment policy, and the School-to-Career initiative. Joseph Wall, Jose Colon, Ronnie Skerker, Dayl Walker, other administrators and teachers at HPHS, and the CBIA partnership deserve credit for helping to produce significant differences in students' performance in academic subjects.

Briefly, all entering 9th graders must enroll in the Academy for Excellence and Career Exploration. The various houses in the Academy for Excellence provide options to individual students that ensure the greatest opportunity for their success with the 9th grade curriculum and eventual completion of high school graduation requirements. The principal and his staff have established specific and measurable goals for each of the main components of the Academy for Excellence.

Analysis of HPHS dropout data shows that the 9th grade should be targeted for intervention because it has the highest record of dropout. The new 9th grade program at HPHS seems to be a direct and effective means of lowering the dropout rate. It provides students with individualized attention to support their academic achievement and to monitor their behavior—namely, attendance and MDOs. Additionally, teachers and staff receive professional development opportunities that are keyed directly to the program and to students' learning, their emotional, and their social-psychological needs.

Additionally, the Academy for Excellence and the opportunities available to students in their 10th, 11th, and 12th grades are consistent with and highly supportive of the School-to-Career program that CBIA and its partners have promoted, since 1994, and that is a key part of a national agenda for career development among America's youth. The main themes of this approach to high school education are hands-on learning, student-centered and student-directed activities, collaborative learning, technology-based education, and promotion of students' career interests. Representatives from CBIA and from CSDE have provided valuable assistance to the curriculum and program restructuring process at HPHS. Also, during the developmental and implementation stages, the administration and teaching staff at HPHS have cooperated fully with these and with other external resources.

An especially important new development at HPHS is the Pitsco science laboratories where 9th grade students work individually and in small groups

to master the science curriculum, with guidance from their teachers. Pitsco offers an integrated approach to science education that incorporates the latest technology and objective-based assessment, and provides students with opportunities for self-directed learning as well as collaborative activities.

Anecdotal data from teachers, administrators, and other observers indicates that the students find the Pitsco labs to be highly motivational. Average Daily Attendance seems to be improving as a result of implementing this innovative program. *Preliminary analysis of student performance data suggests that the students not only like the new science labs, but also that they are learning English, mathematics, and science.*

This analysis of 9th grade student records at HPHS for the first reporting period of 1998 and 1999 is preliminary, but reveals significant differences in favor of the 1999 cohort of students. The mean scores of the 1999 9th graders for English, math, and science were higher than the mean scores for the 1998 9th graders in these same subjects. Also, the mean scores for the 1998 9th graders were in the failure range, whereas the mean scores for the 1999 9th graders were in the "Average" to "Below Average" range (59% is failure at HPHS).

Although the conclusion to this study is somewhat tentative at this time, the most reasonable summation is that the new 9th grade Academy for Excellence and Career Exploration and the School-to-Career program at HPHS are producing positive achievement results and are contributing to a lower incidence of absenteeism and MDOs for the students. That is very good news for Hartford Public High School, for the Hartford Public Schools, for the Connecticut State Department of Education, and for the Connecticut Business and Industry Association.

On the basis of this preliminary study, CRE strongly encourages all interested parties to continue their support of these programs and to insist on systematic analysis of program and student performance data, so that long-term positive results are assured—especially for Hartford's youth and their careers.

Recommendations for continued development follow.

RECOMMENDATIONS

As a result of the analysis of data, the following recommendations are offered to help maintain the progress achieved thus far and to ensure ongoing, positive development of the 9th grade Academy for Excellence and Career Exploration, the School-to-Career program, and the ultimate success of HPHS.

HPHS Program Development

- Continue to support and to develop the Academy for Excellence and Career Exploration and the School-to-Career program.
- Evaluate the development and the effectiveness of the 9th grade Academy for Excellence and Career Exploration relative to its goals and state standards.

HPHS Data Collection

- Establish and maintain a database for all entering students, including students' CMT scores for elementary and middle schools.
- Establish and maintain a database to document CAPT scores for 10th graders.
- Create a system for continuous and systematic collection, analysis, and reporting on student performance in 10th, 11th, and 12th grades—including course grades, grade point averages, and standardized test results.
- Create a system for continuous and systematic analysis of student attendance, tardy, suspension, and MDOs in order to determine the "holding power" of changes in curriculum. In other words, did changes in the programs and curriculum contribute to lower absenteeism, lower dropout, and fewer instances of MDOs? Also, if there is a correlation between attendance and achievement, this finding will validate results measured in achievement across subjects and houses.
- Monitor cohorts of students across classes and programs from 9th through 12th grades to document students' achievement gains—in order to increase the high school graduation rate for all cohorts.
- Collect and analyze qualitative data on HPHS program development with an on-going field study.

Program Assessment and Evaluation

- Ensure that the systematic and continuous collection, analysis, and reporting of student achievement and student behavior becomes a high quality longitudinal study (at least five years) by providing adequate annual funding.
- In order to hold down costs and to provide for timely, objective reporting of the above concerns, retain an independent external consultant with expertise in research and evaluation and sufficient familiarity with the history and context of education at HPHS. This person would have to work in partnership with HPHS, CSDE, and CBIA.
- As soon as sufficient data has been collected and analyzed to indicate and to explain success (within 3 to 5 years), replicate the program at the two other high schools in Hartford.

Basically, the above recommendations concern implementing a system for collection and analysis of critical student performance data at HPHS. An effective evaluation and research program at HPHS will not only inform all concerned internal and external partners regarding the accomplishments of the Academy for Excellence and Career Exploration and the School-to-Career program, it will also clarify the programs to key personnel, identify and explain issues as they arise, and provide data-based recommendations for decision-making and long-range planning.

METHODOLOGY

The methods of research included collection of existing student performance records from HPHS and interviews with administrators, teachers, and representatives from CSDE and from CBIA. Thus, both quantitative and qualitative data were included in this study. The data were entered into a Windows-based Statistical Package for the Social Sciences (SPSS) for development of a data base and follow-up statistical inquiry. Analytical procedures included descriptive statistics for the quantitative data and field study techniques for the qualitative data. Additionally, the principal evaluator discussed issues and problems relevant to the Academy for Excellence and Career Exploration and the School-to-Career program with key internal and external personnel. Also, the principal evaluator provided consulting services to all partners, based upon need.

AUTHORS

Curriculum Research and Evaluation is a firm that is devoted to research and development of programs in the field of education. CRE's specialities are: (1) to provide services in order to evaluate the quality of education programs for private business and industrial companies, public and private funding agencies, and schools; and (2) to develop and guide the implementation of curriculum and instruction.

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APPENDIX

ANALYSIS OF STUDENT ACADEMIC ACHIEVEMENT DATA

Once again, the main question for this study is: *What has been the impact on 9th grade student performance from recent changes in the HPHS curriculum and enrollment policies?*

With cooperation and assistance from HPHS, CRE created a database of 9th grade student performance data from the first reporting period of 1998 and 1999. The data was recorded using the Statistical Package for the Social Sciences (SPSS). Analysis of data employs descriptive statistics—namely measurement of minimum and maximum scores,[5] mean,[6] standard deviation,[7] and parametric statistical tests[8]—namely, Analysis of Variance ANOVA[9]. The confidence interval[10] was set at 95%.

In order to respond to the leading question stated above, a number of more specific questions are useful for analysis of data and discussion of results.

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[5]Minimum and maximum scores are the lowest and highest scores in a list of scores.

[6]Mean is the arithmetic average of a list of scores.

[7]Standard deviation is a measure of dispersion around the mean, expressed in the same units of measurement as the observations, equal to the square root of the variance.

[8]Parametric tests are techniques of inference—inferential statistics—that involve data being sampled from a population with certain characteristics, most typically that the variables in question are normally distributed, and that they are at least intervally scaled (i.e., students' grades).

[9]Analysis of Variance (ANOVA) is used for assessing the statistical significance of the relationship between categorical independent variables (i.e., Day House or Twain House) and a single continuous dependent variable (e.g., grades for English, math, and science).

[10]A confidence interval means that there is a 95% confidence that the true mean is between the limits specified.

Comparison of 1998 and 1999 Average Grades

- *What are the descriptive statistics for English, math, and science grades awarded to students in the 1998 and 1999 cohorts?*

The table below presents a summary of descriptive statistics for the first reporting period for 9th graders in 1998 and 1999.

Means and Standard Deviations for Course Grades (1998)

	N	Minimum	Maximum	Mean	Std. Deviation
ENGLISH	435	.00	100.00	65.3241	23.3858
MATH	433	.00	100.00	57.2333	26.5381
SCIENCE	430	.00	100.00	59.1628	24.3689
Valid N (listwise)	428				

Means and Standard Deviations for Course Grades (1999)

	N	Minimum	Maximum	Mean	Std. Deviation
ENGLISH	330	.00	100.00	70.9061	20.8527
MATH	326	.00	104.00	63.0613	20.1742
SCIENCE	330	.00	100.00	73.9030	15.1841
Valid N (listwise)	319				

Failure at HPHS is a grade of 59% or lower on a 100 point scale.

The top half of the table above shows that the average or the mean scores for 9th grade students in 1998 for English, math, and science hover around failure. Only in English did the students' mean score register a passing grade (65.3241). However, this grade would be marked as "below average" in a typical five-point system consisting of excellent, above average, average, below average, and failure.

By contrast, in the lower half of the above chart, the mean scores for 9th grade students in 1999 for English, math, and science are passing scores and would appear within the "average" to "below average ranges of a typical five-point grading system.

- ✓ The difference between mean scores in English for 1998 and 1999 is approximately 6 points (70.9061 less 65.3241).
- ✓ The difference between mean scores in math for 1998 and 1999 is 5.828 (63.0613 less 57.2333).
- ✓ The difference between mean scores in science for 1998 and 1999 is 14.7402 (73.9030 less 59.1628).

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Figures 4, 5, and 6 illustrate the differences between the mean, median, and overall distribution of scores for English, math, and science for 9th grade students in 1998 and 1999.

Figure 4 Median Scores for English

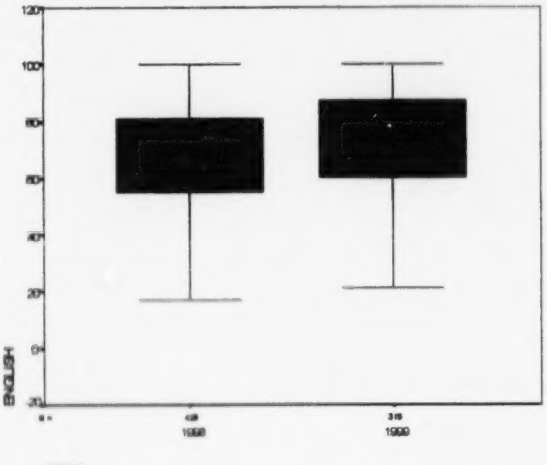


Figure 5: Median Scores for Math

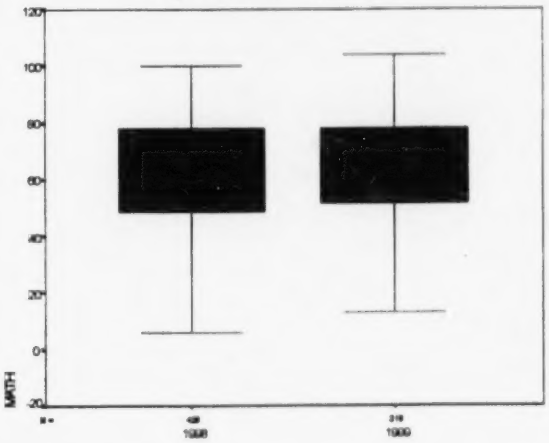
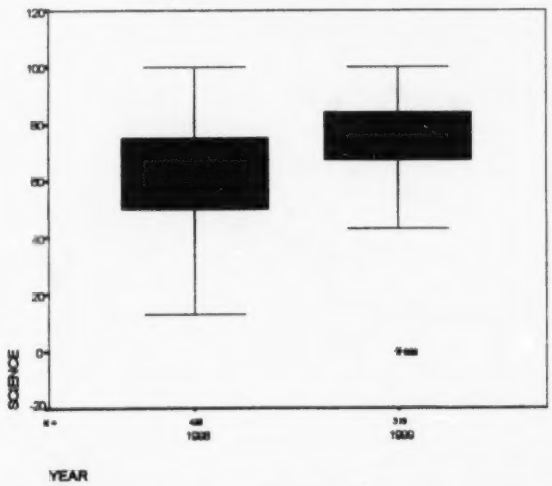


Figure 6: Median Scores for Science



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- *Is there a significant difference between the average grades for the 1998 cohort and the 1999 cohort of students?*

The answer is yes. There is a significant observed difference between the three variables of students' English, math, and science grades and fall reporting period, namely 1998 and 1999. In order to establish that there is significance, a statistical procedure is required that determines if there is a difference between students' grades in English, math and science and whether these differences vary according to which fall reporting period students were enrolled, 1998 or 1999. The Analysis of Variance (ANOVA) is used for this task.

The output for this analysis of data is presented in the table below. The main effect of the two variables (grade and year) shows $F = 11.727$, with $p = .001$ for English; $F = 10.955$, with $p = .001$ for Math; and $F = 93.010$, with $p = .000$ for Science[11]. In other words, the probability that these differences in students' grades in English, math, and science across 1998 and 1999 are due to chance alone is less than one in one thousand.

Analysis of Variance: 1998 and 1999

	Sum of Squares	df	Mean Square	F	Sig.
ENGLISH					
Between Groups	5846.681	1	5846.681	11.727	.001
Within Groups	380413.384	763	498.576		
Total	386260.065	764			
MATH					
Between Groups	6317.085	1	6317.085	10.955	.001
Within Groups	436520.214	757	576.645		
Total	442837.299	758			
SCIENCE					
Between Groups	40567.467	1	40567.467	93.010	.000
Within Groups	330611.502	758	436.163		
Total	371178.968	759			

The obvious implication from the analysis of variance is that something happened during the first reporting period in 1999 that was different from what happened during the same reporting period in 1998, with the outcome that the 9th graders in 1999 realized significantly higher mean scores.

[11]The test statistic for the analysis of variance is called *F*. The *F* ratio compares the average variability between group means with the average variability of scores within groups. The level of significance often is called a "*p*" value because it represents a probability of statistical significance, and typically it is italicized or underlined in a published work. The .05 p value (which we use in this study) has been selected as a good decision-making standard because it is sufficiently stringent to safeguard against accepting too many insignificant results as significant, while also not being too difficult to achieve.

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Analysis of qualitative data, including interviews, documents, and other records indicates that there are several factors which may account for this difference in student performance data:

- ✓ instituting a professional development program that is aligned with a new, interdisciplinary science curriculum (Pitsco)
- ✓ implementing the Pitsco science curriculum
- ✓ reorganizing the high school program to provide different houses based upon students' academic performance in middle school
- ✓ implementing new high school policies for team teaching and collaborative planning
- ✓ implementing a responsive approach to the incidence of student absenteeism, including teachers, administrators, counselors, and parents.

However, it must be understood that the analysis and interpretation of HPHS student performance data from 1998 and 1999 must be considered tentative for these reasons:

- ✓ 9th grade enrollment in fall 1999 is 20% lower than 9th grade enrollment in fall 1998
- ✓ Twain House student enrollment is small by comparison to other houses
- ✓ Thus far, CRE's data base does not include student achievement data from middle and elementary schools
- ✓ More qualitative documentation is needed from the HPHS site in order to attribute the main effect to the impact of curriculum, program, and policy changes on 9th grade students, and
- ✓ A longitudinal study (three to five years) is strongly recommended to identify a sustained main effect over time for different cohorts of 9th grade students.

Comparison of Houses in 1999

- *What are the descriptive statistics for English, math, and science grades awarded to students in the different houses of the 1999 cohort?*

Means and Standard Deviations by House for Course Grades (1999)

HOUSE		ENGLISH	MATH	SCIENCE
Day	Mean	61.5811	59.7973	76.5676
	N	148	148	148
	Std. Deviation	21.7600	19.6427	13.7965
	Minimum	.00	2.00	20.00
	Maximum	100.00	94.00	100.00
Stow	Mean	79.3146	64.5169	72.7753
	N	89	89	89
	Std. Deviation	16.4590	21.2716	17.6260
	Minimum	.00	5.00	.00
	Maximum	99.00	104.00	95.00
Twain	Mean	60.4375	65.8889	61.4000
	N	16	18	15
	Std. Deviation	25.5185	22.3709	23.4636
	Minimum	.00	.00	.00
	Maximum	94.00	90.00	89.00
Classical	Mean	81.2857	67.3239	72.5385
	N	77	71	78
	Std. Deviation	11.8309	18.5286	10.9137
	Minimum	38.00	16.00	49.00
	Maximum	97.00	95.00	96.00
Total	Mean	70.9061	63.0613	73.9030
	N	330	326	330
	Std. Deviation	20.8527	20.1742	15.1841
	Minimum	.00	.00	.00
	Maximum	100.00	104.00	100.00

As indicated earlier, failure at HPHS is a grade of 59% or lower on a 100 point scale.

The above table is organized by house on the rows and courses on the columns. Documentation for each category includes mean, total number of acceptable students, standard deviation, minimum and maximum scores.

- ✓ The mean score for science for students in Day House (76.5676) is approximately 3 points above the mean for the total population (73.9030).
- ✓ The mean scores for English for students in Stowe and Classical houses (79.3146 and 81.2857,respectively) are approximately 9 points above the mean for the total population (70.9061).
- ✓ The mean scores for math and science for students in the total 1999 population are higher than for students in the total 1998 population (see previous table).

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In summary, the descriptive statistics from the first marking period in 1999 for 9th grade students from the different houses indicate that different houses may be producing different achievement levels among students. At this point, the operational question is: Are these results due to chance or are they significant? If significant, then the difference between houses is unlikely to have been brought about by chance variation in students' grades.

- *Is there a significant difference between the average English grades for the 1999 cohort of students in the different houses?*

Yes. There is a significant observed difference between the two variables of students' English grade and house assignment. In order to establish that there is significance, a statistical procedure is required that determines if there is a difference between students' grades in English and whether these differences vary according to students' enrollment in Day House, Stowe House, Twain House, or Classical House. The Analysis of Variance (ANOVA) is used for this task.

The output for this analysis of data is presented in the table below. The main effect of the two variables (grade and house) shows $F = 27.88$, with $p = .000$.[12] The level of significance is .000. Thus, the probability that this difference in students' English grades across houses is due to chance alone is much less than one in one thousand.

ANALYSIS OF VARIANCE
English Grades by House: 1999

```
* * * * * * Analysis of Variance * * * * * *
     319 cases accepted.
       0 cases rejected because of out-of-range factor values.
      28 cases rejected because of missing data.
       4 non-empty cells.
```

Tests of Significance for ENGLISH using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	113848.87	326	349.23		
HOUSE	29211.22	3	9737.07	27.88	.000
(Model)	29211.22	3	9737.07	27.88	.000
(Total)	143060.09	329	434.83		
R-Squared =	.204				
Adjusted R-Squared =	.197				

Combined Adjusted Means for HOUSE
Variable .. ENGLISH

HOUSE		
day	UNWGT.	61.58108
Stow	UNWGT.	79.31461
Twain	UNWGT.	60.43750
Classica	UNWGT.	81.28571

[12]The test statistic for the analysis of variance is called *F*. The *F* ratio compares the average variability between group means with the average variability of scores within groups. The level of significance often is called a "*p*" value because it represents a probability of statistical significance, and typically it is italicized or underlined in a published work. The .05 p value (which we use in this study) has been selected as a good decision-making standard because it is sufficiently stringent to safeguard against accepting too many insignificant results as significant, while also not being too difficult to achieve.

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At the bottom of the table are the adjusted mean scores for each house which report on the analysis of variance on English grades across houses. These mean scores suggest where the greatest effect has been observed.

A *post hoc* test [13] on the differences in mean scores for English across houses reveals that the mean difference between Day House (61.58108) and Stow (79.31461) and Classical (81.28571) houses and between Twain House (60.43750) and Stow and Classical houses are significant at the .05 level.

Thus, English instruction in Stowe and Classical houses produces significantly different results from English instruction in Day and Twain houses.

Some parts of this result are understandable on the basis of information that CRE has obtained and at least one part is somewhat puzzling. Consider the following notes:

- ✓ Day House students automatically enroll there because they scored below 50 in reading and below 100 in math as measured by the CMT.
- ✓ Stowe House students automatically enroll there because they scored between 50 and 62 in reading and between 100 and 130 in math on the CMT.
- ✓ Twain House students automatically enroll there because they have met the 8th grade Connecticut Mastery Test (CMT) goals for reading, writing, and mathematics.
- ✓ Classical House students enroll in an honors program and must have qualifications—including performance in reading, writing, and math— for success in college preparatory courses at HPHS.
- ✓ Mean scores in English for 1999 are higher than in 1998.

Since performance in reading and writing are central to success in English classes, it is understandable that students in Day House might experience difficulty in meeting the standards for the 9th grade English curriculum. Additionally, the students enrolled in Classical House have the highest average among the four houses—which one should expect to report, since this is the honors program. However, the relatively high average score of Stowe House students (79.31461) indicates that, despite their relatively low CMT scores in reading, they have a good overall achievement record for English.

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[13] Once it is determined that differences exist among the means, post hoc range tests and pairwise multiple comparisons can determine which means differ. In this instance, the Scheffe tests was used. Scheffe performs simultaneous joint pairwise comparisons for all possible pairwise combinations of means. It uses the F sampling distribution and can be used to examine all possible linear combinations of group means, not just pairwise comparisons.

CRE recommends follow-up studies on site to determine what curricular, professional development, and other school context factors may account for the relatively high mean score for Stowe House, the relatively low mean scores for Day and Twain Houses, and the relatively mediocre performance of Classical House.

- *Is there a significant difference between the average Math grades for the 1999 cohort of students in the different houses?*

ANALYSIS OF VARIANCE
Math Grades by House: 1999

```
* * * * * * Analysis of Variance * * * * * *
     326 cases accepted.
       0 cases rejected because of out-of-range factor values.
      21 cases rejected because of missing data.
       4 non-empty cells.
```

Tests of Significance for MATH using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	129075.47	322	400.86		
HOUSE	3199.30	3	1066.43	2.66	.048
(Model)	3199.30	3	1066.43	2.66	.048
(Total)	132274.77	325	407.00		

R-Squared = .024
Adjusted R-Squared = .015

Combined Adjusted Means for HOUSE
Variable .. MATH

HOUSE		
day	UNWGT.	59.79730
Stow	UNWGT.	64.51685
Twain	UNWGT.	65.88889
Classica	UNWGT.	67.32394

At the bottom of the table are the adjusted mean scores for each house which report on the analysis of variance on math grades across houses. Examination of mean scores can determine where the greatest effect has been observed.

A *post hoc* test [14] on the differences in mean scores for math across houses reveals that the mean difference between Day House (59.79730) and Classical house (67.32394) is significant at the .05 level.

CRE concludes that the mean scores for all houses are low and HPHS should consider revising the math curriculum and aligning professional development in order to improve students' achievement in math. A clue to what should be done is revealed in the analysis of variance of science grades.

[14] Once it is determined that differences exist among the means, post hoc range tests and pairwise multiple comparisons can determine which means differ. In this instance, the Scheffe tests was used. Scheffe performs simultaneous joint pairwise comparisons for all possible pairwise combinations of means. It uses the F sampling distribution and can be used to examine all possible linear combinations of group means, not just pairwise comparisons.

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- *Is there a significant difference between the average science grades for the 1999 cohort of students in the different houses?*

The answer is yes. There is a significant observed difference between the two variables of students' science grade and house assignment. In order to establish that there is significance, a statistical procedure is required that determines if there is a difference between students' grades in science and whether these differences vary according to students' enrollment in Day House, Stowe House, Twain House, or Classical House. The Analysis of Variance (ANOVA) is used for this task.

The output for this analysis of data is presented in the table below. The main effect of the two variables (grade and house) shows $F = 5.50$, with $p = .001$.[15] The level of significance is .001, or in other words, the probability that this difference in students' science grades across houses is due to chance alone is less than one in one thousand.

ANALYSIS OF VARIANCE
Science Grades by House: 1999

```
* * * * * * Analysis of Variance * * * * * *
        330 cases accepted.
          0 cases rejected because of out-of-range factor values.
         17 cases rejected because of missing data.
          4 non-empty cells.
```

Tests of Significance for SCIENCE using UNIQUE sums of squares

Source of Variation	SS	DF	MS	F	Sig of F
WITHIN+RESIDUAL	72198.81	326	221.47		
HOUSE	3654.08	3	1218.03	5.50	.001
(Model)	3654.08	3	1218.03	5.50	.001
(Total)	75852.90	329	230.56		

R-Squared = .048
Adjusted R-Squared = .039

Combined Adjusted Means for HOUSE
Variable .. SCIENCE

HOUSE		
day	UNWGT.	76.56757
Stow	UNWGT.	72.77528
Twain	UNWGT.	61.40000
Classica	UNWGT.	72.53846

[15]The test statistic for the analysis of variance is called *F*. The *F* ratio compares the average variability between group means with the average variability of scores within groups. The level of significance often is called a "*p*" value because it represents a probability of statistical significance, and typically it is italicized or underlined in a published work. The .05 p value (which we use in this study) has been selected as a good decision-making standard because it is sufficiently stringent to safeguard against accepting too many insignificant results as significant, while also not being too difficult to achieve.

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Additionally, the adjusted mean scores for each house are listed at the bottom of the table reporting analysis of variance on science grades across houses. Examination of mean scores is a good way to determine where the greatest effect has been observed.

A *post hoc* test [16] on the differences in mean scores for science across houses reveals that the mean difference between Day House (75.56757) and Twain House (61.40000) is significant at the .05 level.

Thus, science instruction in Day House produces significantly different results from science instruction in Twain House.

Additionally, although the result is not statistically significant, the mean score for science in Day House also exceeded mean scores in Stowe and Classical houses. To appreciate this result, it is important to recall the following items:

- ✓ Pitsco science curriculum was implemented in Day House and Stowe House in fall 1999.
- ✓ Day House students are automatically enrolled there because they scored below 50 in reading and below 100 in math as measured by the CMT.
- ✓ Stowe House students are automatically enrolled there because they scored between 50 and 62 in reading and between 100 and 130 in math on the CMT.
- ✓ Mean scores in English, math, and science—and especially in science—for 1999 are higher than in 1998.

Thus, it is plausible to assert that the Pitsco science curriculum—because it is a highly motivating and an integrated disciplines approach to teaching science—is a main contributing factor to overall improvement in mean scores for all 1999 students in English, math, and science.

[16] Once it is determined that differences exist among the means, post hoc range tests and pairwise multiple comparisons can determine which means differ. In this instance, the Scheffe tests was used. Scheffe performs simultaneous joint pairwise comparisons for all possible pairwise combinations of means. It uses the F sampling distribution and can be used to examine all possible linear combinations of group means, not just pairwise comparisons.

Figures 7, 8, and 9 illustrate the differences in mean scores for courses taken by 9th graders enrolled in the different houses in 1999.

Figure 7: English and Math by House

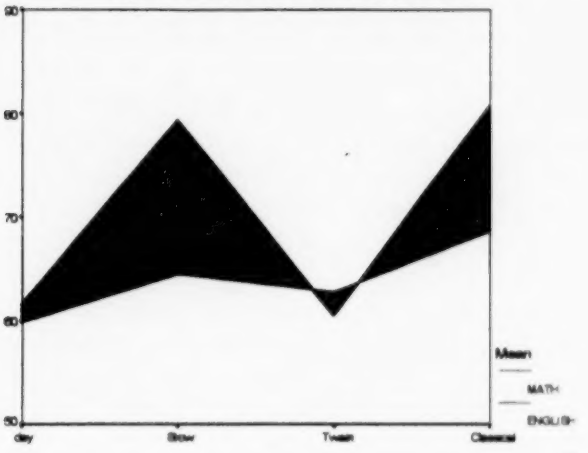


Figure 7: Science and Math by House

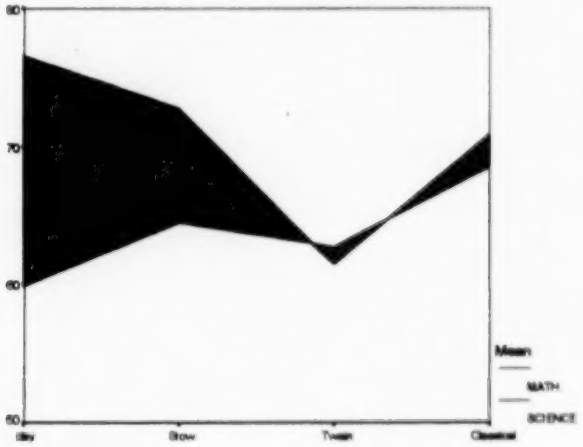
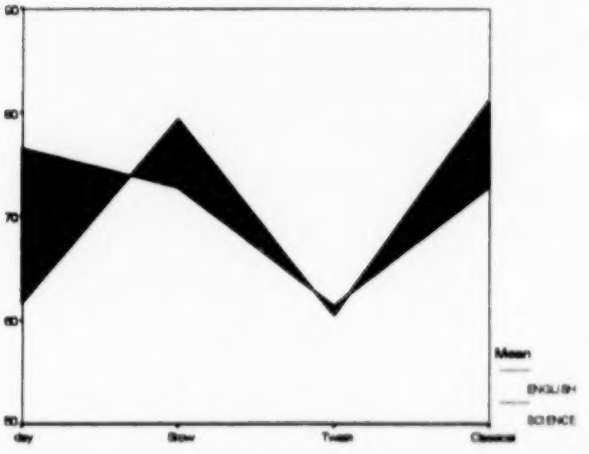


Figure 7: English and Science by House



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Since more than 20% of the variation in English scores is accounted for by students' placement in a house—and only 2% and 5% for math and science respectively, additional analysis was done to examine the correlation between students' grades in English, math, and science irrespective of house assignment. Results suggest that there is a strong relationship between students' scores in English and math, but not so strong a relationship between English and science. Perhaps this result is due to house enrollment policies that concentrate on students' CMT scores in English and mathematics. If so, this finding validates that the entrance requirements are working for the students' benefit. However, more data is needed to explain this effect with confidence. Nevertheless, this finding at least suggests that teachers and administrators may be able to configure team teaching assignments in English and math courses to take advantage of the positive correlation noted between observed mean scores in English and math.

Attendance, Tardy, and Suspension Records

CRE obtained records of attendance, tardy, and suspension for the first quarter for the 1998 9th grade class and records of Average Daily Attendance (ADA), in addition to team minutes, phone logs, and parent/teacher conferences for the 1999 9th grade class. However, these different data sets are not easily comparable because the 1998 system and software for keeping track of students' behavior is no longer used and is not the same as the system and software for 1999. Actually, the 1999 monitoring process is superior to the old system because it includes more information about individual students and groups of students. Also, in time, the ADA process will be used consistently across all clusters and houses and will provide valuable data for monitoring students' attendance and responses to various interventions.

The descriptive statistics in the table below concern the incidence of absenteeism and were computed for the 9th grade class during the first reporting period of 1998.

ABSENTEEISM FOR 1998 FIRST REPORTING PERIOD: 9TH GRADE				
N= 435	Minimum	Maximum	Mean	Std. Deviation
	0 days	41 days	5.2184 days	7.0884

The report of Average Daily Attendance for the 9th grade class during the first reporting period of 1999 indicated an overall ADA rate of 88%. In the years ahead, it will be important to monitor the ADA and MDOs in order to determine if there is improvement.